ECS 132 Spring 2019
Due: May 3, 2018

Ecs 132 Homework 2

Problem 1:

1. Show, citing the mailing tubes, that if X and Y are independent random variables, then Var(X - Y) = Var(X) + Var(Y).
2. Consider the bus ridership example. Intuitively, L_1 and L_2 are not independent, so we suspect (a) does not hold with $X = L_2$ and $Y = L_1$. Determine the difference. (Find the three variances analytically, **and confirm via simulation.**)

Problem 2:

The game is to toss a coin until we get **r** consecutive heads or reach a total of **s** tosses, whichever comes first.

Let X denote the number of tosses we make. We win $X. Find the minimum fee that should be charged for this game if r = 3 and s = 6. **Confirm via simulation.**

Problem 3:

Here we will be interested in *permutations*, which are like combinations but with all possible orderings. For instance, suppose we are looking at subsets of 1,2,...,8, taken two at a time. Corresponding to the combination (2,7), the permutations are (2,7) and (7,2). For the combination (1,2,7), the permutations are (1,2,7), (2,1,7), (1,7,2), (7,2,1), (7,1,2) and (2,7,1).

a. Write a functions with call form

```
permn(x,m,FUN)
```

analogous to **combn()** but for permutations. **FUN** (which has no default, i.e. cannot be NULL) is applied to each permutation, so that **permn()** returns a vector consisting of the values of **FUN** at the various permutations of **x** taken **r** at a time.

You will NOT be required to save memory, i.e. if you wish, you can have your **permn()** first generate all permutations, then call **FUN()** on each one. However, **FUN** must be an argument of **permn()**, as above.

There are permutation generators in the **partitions** and **gtools** packages, available on CRAN.

Example:

```
> first <- function(z) z[1]
> permn(7:10,2,first)
 [1]  7  8  7  9  7 10  8  9  8 10  9 10
```

b. Apply your **permn()** to solve the following problem. We choose 8 numbers, $X_1,\ldots,X_8$ from 1,2,...,12. We are interested in the quantity $W = \Sigma_{i=1}^{7} |X_{i+1} - X_i|$. Find EW.

Problem 4:

Let X be a random variable that denotes the sum of the values on a roll of 2 dice(4 sided dice with equal prob of getting any face).

1. What values does the random variable take?
2. Find the pmf.
3. What is the expected value of X?

Problem 5:

5 The Binomial Distribution
Suppose that the microchip a company produces passes inspection at a 97% rate. If the company sends 10 chips out for inspection.

1. Use R to plot the probability of 0-10 chips passing inspection.

2. What is the probability that at least 2 of the chips fails inspection?